

REMARKS

In response to the Office Action dated January 7, 2004, Applicants respectfully request reconsideration based on the above claim amendment and the following remarks. Applicants respectfully submit that the claims as presented are in condition for allowance.

Claims 1 and 4-6 are pending the present application. Claim 1 has been amended and claim 4 has been canceled without prejudice, leaving claims 1 and 5-6 for consideration upon the entry of the amendment. Support for the amendment can be found in the entire specification, for example, on page 8, lines 3-8 or page 10, lines 12-19 of the specification. No new matter has been added by the amendment.

Claim Rejections Under 35 U.S.C. § 103

Claims 1, 4 and 6

Claims 1, 4 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Albridge Jr. et al., US 4,775,789 (hereinafter "Albridge") for the reasons stated on the pages 2-3 of the Office Action. Since claim 4 has been canceled without prejudice, the rejection of claim 4 is moot.

Claim 1 is a method of etching a semiconductor device using a neutral beam comprising: extracting an ion beam having a predetermined polarity from an ion source to accelerate the ion beam; reflecting an accelerated ion beam by a reflector to completely neutralize a reflected ion beam, wherein an incident angle of the ion beam incident on the reflector is in a range of 75 – 85 degree from a vertical line to a horizontal surface of the reflector; and positioning a substrate to be etched in a path of a neutral beam to etch a material layer on the substrate with the neutral beam.

The Examiner states that Albridge clearly discloses that the angle of incident of the ion beam is a result effective variable and the result effective variable is commonly determined by routine experiment. Applicants respectfully disagree with the Examiner. Where the difference between the claimed invention and the prior art is some range or other variable within the claims, a prima facie case of obviousness may be rebutted, generally by showing that the claimed range achieves unexpected results relative to the prior art. See MPEP § 2144.5, III.

The method of claim 1 achieves unexpected results, that is, the complete neutralization of an ion beam, by controlling an incident angle of the ion beam incident on the reflector in a range of 75 – 85 degree from a vertical line to a horizontal surface of the reflector. Figs. 5 and 7 of the application show the variation in an etch rate with respect to the incident angle of an ion beam and the resulting etch patterns, respectively. As shown in Figs. 5 and 7, the etch rate increases at the incident angle of the ion beam incident on the reflector in the range of 75 - 85 degree from a vertical line to a horizontal surface of the reflector, thereby nearly completely neutralizing the ion beam (See page 9, lines 20-27 and page 10, lines 13-19 of the Application).

On the contrary, Albridge discloses that it has been found that the angles of 1 to 4 degrees provide high efficiency of operation, and that, as angle increases, the invention still operates but with reduced efficiency. That is, Albridge teaches that the incident angle should be less than 4 degrees to have high efficiency of ion neutralization. Thus, the method of claim 1 achieves unexpected result relative to Albridge, by controlling the incident angle of the ion beam incident on the reflector in a range of 75-85 degree from a vertical line to a horizontal surface of the reflector. Accordingly, the range of the incident angle recited in claim 1 is critical, and Albridge does not teach or suggest the feature “an incident angle of the ion beam incident on the reflector is in a range of 75 – 85 degree from a vertical line to a horizontal surface of the reflector”, as recited in claim 1. Claim 6 depends from claim 1, thus is believed to be allowable due to its dependency on claim 1.

Claims 1, 4-6

Claims 1, 4-6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Motley Jr. et al., US 4,662,977 (hereinafter “Motley”) for the reasons stated on the pages 3-4 of the Office Action. Since claim 4 has been canceled without prejudice, the rejection of claim 4 is moot.

The Examiner states that although Motley fails to explicitly disclose value of the angle of the incidence of the ion beam on the reflector from a vertical line to a horizontal surface of the reflector, Motley clearly teaches the angle of the incident is a result effective variable and the result effective variable is commonly determined by routine

experiment. As described above, the feature "the incident angle of the ion beam incident on the reflector in a range of 75 – 85 degree from a vertical line to a horizontal surface of the reflector beam" of claim 1 is critical to achieve the complete neutralization of the ion beam, and the feature of claim 1 is not suggested or taught by Motley for at least the reasons stated above. Thus, Motley does not render claim 1 obvious. Claims 5 and 6 depend from claim 1, thus are believed to be allowable due to their dependency on claim 1.

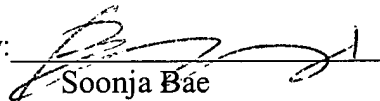
Conclusion

In view of the forgoing amendments and remarks, Applicants submit that this application is in condition for allowance. Early notification to this effect is requested.

If there are any charges due in connection with this response, please charge them to Deposit Account 06-1130.

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